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GREENHOUSE TOMATO BREEDING SUMMER CROP 1988 FIELD EVALUATION TRIALS, WOOSTER

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OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER
WOOSTER

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Greenhouse Tomato Breeding Summer Crop 1988
Field Evaluation Trials, Wooster

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Greenhouse and fresh market field beefsteak type cultivars were evaluated in the field at The OARDC/OSU in Wooster to compare performance and to identify potentially important greenhouse cultivars. Seed for this trial was donated by The OARDC/OSU and 10 seed companies (Table 1a). The response of the cultivars in the trial to some of the major tomato diseases is presented in Table 2.

Materials and Methods

Thirty-one greenhouse cultivars and 3 field cultivars were evaluated in a replicated trial in the summer of 1988. The trial had 12 plants/entry divided into 3 replications. Seeds were sown into wooden flats on April 15 and seedlings were thinned to 72 plants/flat. Plants were hardened by withholding water 2 weeks before planting.

Plants were spaced in the field 12" within and 48" between rows on May 20. The planting was fertilized on May 25 with 523 lbs./acre of 10-20-20 and on June 20 and July 20 with 174 lbs./acre of 10-20-20 and Ca_2NO_3. Stakes were placed at 2 plant intervals and twine was wrapped between stakes throughout the season to support the plants. Plants were pruned to a central leader and topped at 4.5

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11/89-H-781-100

Table 1a. Name and address of the seed companies that donated seed for this study.

Table Code		
1.	OE	Ohlsens Enke, J.E. Ohlsens Enke A/S, P.O. Box 15, OK-5100 Odense C. Denmark.
2.	TK	Takii & Co., Ltd., C.P.O. Box 7, Kyoto, Japan
3.	EZ	Enza Zaden B.V. Halingle Enkhuizen, Holland
4.	CL	(Clause)-Julius Wagner Heidelberg, Box 105, 880 6990 Heidelburg
5.	JL	Julius Wagner Heidleberg, Box 105, 880 6990 Heidelburg
6.	SG	Sluis & Groot, P.O. Box 13, 1600 AA Enkhuizen, Holland
7.	BR	Bruinsma Seeds b.v., P.O. Box 24, 2670 AA Naaldwijk, Holland
8.	JH	Joseph Harris Co., Moreton Farm, 3670 Buffalo Rd., Rochester, NY 14624
9.	OH	Ohio Agricultural Research & Development Center/The Ohio State University, Wooster, OH 44691
10.	ST	Stokes Seeds, Inc., Buffalo, NY 14240
11.	AC	Abbott & Cobb, Inc., Box F307, Feasterville, PA 19047

Table 1b. Weather Data from the OARDC weather station, Wooster.

Month	Mean Temp.°F Max.	Min.	% Relative Humidity Max.	Min.	Precipitation (inches)	Evaporation (inches)
June	83	51	86	40	0.02	0.32
July	90	61	86	37	0.21	0.32
August	84	61	86	66	0.11	0.24
September	74	51	92	70	0.10	0.16

Table 2. The response of the cultivars in this trial to some of the major greenhouse tomato diseases.[zyx]

Entry Seed Source	Type	TMV	Major Greenhouse Tomato Diseases: Fusarium Crown Root Rot (FCRR)	Fusarium Race 1 (I)	Fusarium Race 2 (I-2)	Verticillium Race 1 (Ve)	Root Knot nematode (M. incognita) (Mi)	Cladosporium Races 1&10 (C2)	Cladosporium Races 1,6,10 11&12 (C5)
Simona F_1/OE	G	R	S	R	S	R	R	S	S
Cancan F_1/OE	G	R	S	R	S	S	S	R	S
Palace/TK	G	S	S	S	S	S	S	S	S
Tropic Boy/TK	G	S	S	S	S	S	S	S	S
Master No. 2/TK	G	S	S	S	S	S	S	S	S
Fontana/EZ	G	R	S	R	R	S	R	-	R
Bermuda/EZ	G	R	S	R	R	S	R	-	R
Amfora/EZ	G	R	S	R	R	S	S	-	R
Tango/CL	G	R	S	R	S	R	S	S	S
Pyros/CL	G	S	S	R	S	R	S	S	S
Pyrella/JL	G	R	S	S	S	R	R	-	R
Dona/JL	G	R	S	R	R	R	R	S	S
St. Pierre/JL	G	S	S	S	S	S	S	S	S
Master F_1/JL	G	S	S	S	S	S	S	S	S
Fandango/JL	G	S	S	S	S	S	S	S	S
Carmello/SG	G	R	S	R	S	R	R	S	S
Nancy/SG	G	R	S	R	S	R	S	S	S
Erlicor/SG	G	R	S	R	S	R	S	S	S
GC 771/SG	G	R	S	R	S	R	R	-	R
F 210/SG	G	R	S	R	S	R	R	S	S
Alonso/SG	G	R	S	R	S	R	R	-	R
Kendo/SG	G	R	S	R	R	R	R	S	S
GS 130/SG	G	R	S	R	S	R	R	S	S
Vemar/SG	G	R	S	R	S	R	S	-	R
Ramy/SG	G	R	S	R	R	R	R	S	S
Rambo/SG	G	R	R	R	R	R	R	S	S
GC 779/SG	G	S	S	S	S	S	S	S	S
Dombello/BR	G	R	R	S	R	R	R	-	R
Jet Star/JH	F	S	S	R	S	R	S	S	S

Table 2. The response of the cultivars in this trial to some of the major greenhouse tomato diseases.[zyx] (cont.)

Entry Seed Source	Type	TMV	Major Greenhouse Tomato Diseases: Fusarium Crown Root Rot (FCRR)	Fusarium Race 1 (I)	Fusarium Race 2 (I-2)	Verticillium Race 1 (Ve)	Root Knot nematode (M. incognita) (Mi)	Cladosporium Races 1&10 (C2)	Cladosporium Races 1,6,10 11&12 (C5)
Jumbo/BR	G	S	S	R	R	R	S	S	S
CR-6/OH	G	R	R	R	S	R	S	S	S
Early Set/JH	G	R	S	R	R	R	R	S	S
Pole King/AC	G	S	S	R	R	R	S	S	S
Vendor/ST	G	S	S	S	S	S	S	S	S

[z]Greenhouse cultivar = G and Field cultivar = F
[y]Resistant = R and Susceptible = S
[x]All the entries are hybrids except Vendor, and CR-6 is the only entry with pink fruit.

feet. One inch of water per week either from rainfall or irrigation was provided. Weather data for the summer is presented in Table 1b.

Fruit harvesting and grading started on July 25 and continued every week for 5 weeks. Fruit was graded into 5 classes (No. 1 large, over 255g (9 oz); No. 1 medium, from 255g to 99g (3.5 oz); No. 1 small, under 99g; No. 2; and cull) every week and according to 8 fruit disorder categories (puff, cracks, off-shape, rough, off-color, blossom end rot, zippered and mixed). No. 1 fruits consisted of well formed tomatoes which were free from defects. No. 2 fruits were reasonably well formed tomatoes which were free from damage caused by physiological disorders, disease, insects or other means. Fruits were placed in the mixed category if more than one disorder occurred.

Results

Four greenhouse cultivars ('Dombello', 'Jumbo', 'CR-6' and 'Vendor') and three field cultivars ('Jet Star', 'Early Set' and 'Pole King') were used as standards to compare the performance of the other entries. Because greenhouse cultivars are more susceptible to cracking in a field environment, cracking was ignored as a defect when fruits were being placed into marketable and cull categories. All the cultivars in the study produced a higher percentage of marketable fruit than 2 of the standards 'Jet Star' (76.7%) and 'CR-6' (73.7%) (Table 3). The cultivars that produced the most No. 1 large fruits/plant also had the largest average fruit size ('Pole King', 3.7 and 226g; 'Jumbo', 3.2 and 221; GS 130, 3.7 and 217g). The other entries that had an average fruit size greater than 165g were 'Simona' (191g), 'Carmello' (191g), 'Pyros' (171g), GC 771 (169g), 'Dombello' (166g) and 'Jet Star' (166g). The cultivars with the highest yield were 'Tropic Boy' (3475 g/plant), 'Fandango' (3287 g/plant) and 'Carmello' (3281

Table 3. Comparison of field-grown tomato cultivars for graded fruit classes, yield, fruit size, and percent No. 1 and No. 2 fruit for the entire 5 weeks of this trial.[zy]

Entry/ Source	Type	# of No.1 Lg./ Plt	# of No.1 Md./ Plt	# of No.1 Sm/ Plt	# of No.2 /plt	# of Culls /plt	Fruit wt/plt (g)	Fruit Size (g)	% No.1 fruit	% No.1 & No.2 fruit
Simona F_1/OE	G	2.5	8.2	1.7	0.3	3.5	3083	191	76.7	78.3
Cancan F_1/OE	G	0.9	11.4	1.8	0.6	2.6	2846	164	81.8	85.2
Palace/TK	G	0.3	8.7	3.1	0.5	3.3	2272	139	77.2	80.2
Tropic Boy/TK	G	0.7	15.6	1.9	0.8	2.8	3475	160	83.7	87.1
Master No.2/TK	G	0.2	11.6	3.2	1.1	2.0	2637	147	83.1	89.1
Fontana/EZ	G	0.7	12.2	3.7	0.8	1.2	2626	141	89.6	93.6
Bermuda/EZ	G	1.2	10.7	3.1	1.0	1.9	2749	153	83.4	89.0
Amfora/EZ	G	0.2	21.4	6.0	0.1	0.4	2879	102	98.2	98.5
Tango/CL	G	2.0	16.4	5.2	0.8	0.9	3268	129	93.5	96.4
Pyros/CL	G	2.7	12.3	1.6	1.0	1.4	3235	171	86.0	91.9
Pyrella/JL	G	0.1	14.3	10.8	0.0	0.8	2552	98	96.4	96.4
Dona/JL	G	0.5	16.2	3.7	0.4	1.7	2919	129	90.8	92.6
St. Pierre/JL	G	0.1	11.6	5.3	0.3	2.3	2549	129	86.5	88.1
Master F_1/JL	G	1.0	10.9	3.2	0.6	1.3	2264	133	89.1	92.6
Fandango/JL	G	0.2	16.7	3.5	1.4	1.1	3287	142	89.1	95.3
Carmello/SG	G	2.0	12.0	1.6	0.7	0.9	3281	191	90.7	94.6
Nancy/SG	G	1.1	13.1	4.3	0.8	1.2	3110	153	90.6	94.4
Erlicor/SG	G	1.2	13.6	3.2	0.8	2.2	3141	149	86.2	89.8
GC 771/SG	G	0.7	9.7	1.0	0.5	2.0	2358	169	82.1	85.7
F. 210/SG	G	0.7	15.2	2.6	0.5	1.3	2973	147	91.3	93.8
Alonso/SG	G	0.6	10.1	3.3	0.8	2.2	2445	146	83.5	88.0
Kendo/SG	G	0.6	12.3	3.6	0.1	1.1	2768	157	93.3	93.7
GS 130/SG	G	3.7	5.2	2.4	0.3	1.3	2721	217	88.0	90.4
Vemar/SG	G	0.0	12.6	6.1	0.2	3.1	2548	116	84.8	85.6
Ramy/SG	G	0.7	13.1	2.2	0.0	0.8	2626	157	95.0	95.0
Rambo/SG	G	1.0	10.6	2.4	0.3	1.8	2554	158	87.1	88.6
GC 779/SG	G	0.4	11.7	3.0	0.0	2.8	2583	146	84.8	84.8
Dombello/BR	G	1.3	11.4	3.7	0.8	1.7	3140	166	87.4	91.4
Jet Star/JH	F	1.9	9.2	2.0	1.3	4.3	3113	166	70.1	76.7
Jumbo/BR	G	3.2	7.4	0.5	0.3	1.4	2854	221	87.0	89.5
CR-6/OH	G	0.7	7.4	2.8	0.3	3.9	1908	123	72.2	73.7

Table 3. Comparison of field-grown tomato cultivars for graded fruit classes, yield, fruit size, and percent No. 1 and No. 2 fruit for the entire 5 weeks of this trial.[zy] (cont.)

Entry/ Source	Type	# of No.1 Lg./ Plt	# of No.1 Md./ Plt	# of No.1 Sm/ Plt	# of No.2 /plt	# of Culls /plt	Fruit wt/plt (g)	Fruit Size (g)	% No.1 fruit	% No.1 & No.2 fruit
Early Set/JH	F	0.7	12.0	5.7	1.0	2.3	2862	135	84.5	89.3
Pole King/AC	F	3.7	7.1	0.4	0.3	2.0	3048	226	82.8	85.7
Vendor/ST	G	0.4	10.7	8.7	0.3	2.8	2565	114	86.5	87.6
LSD 5%		1.4	3.4	2.8	0.8	1.2	628	30	7.9	6.8

[z]No. 1 fruit consists of well formed smooth tomatoes free from defects (Large over 255g [9 oz.]; Medium from 255g to 99g [9 oz.-3.5oz.]; Small under 99g). No. 2 fruit consists of reasonably well formed tomatoes which are free from damage caused by physiological disorders, disease, insects, or other means.
[y]Greenhouse cultivar = G and Field cultivar = F.

g/plant). The highest percentage of marketable yield was achieved by 'Amfora' (98.5%), 'Tango' (96.4%), 'Fandango' (95.3%) and 'Ramy' (95.0%). Two greenhouse cultivars that had a better or equal combination of yield, fruit size and % marketable fruit compared to the standard cultivars were 'Carmello' (3281 g/plant, 191g and 94.6%, respectively) and GS 130 (2721 g/plant, 217g and 90.4%, respectively).

The main cause for fruit rejection was either roughness or blossom end rot because fruit cracking was not considered a major defect in this field environment (Table 4). Overall, none of the cultivars produced many puffy or off-colored fruits. The entries with the least amount of cracked fruit were 'Tropic Boy' (24.1%), 'Jet Star' (35.4%) and 'Early Set' (37.5%). The smoothest and most uniform fruit was produced by 'Amfora' (% rough, 0.3; % off-shape, 0.0), 'Kendo' (% rough, 1.5; % off-shape, 1.0) and GC 779 (% rough, 2.3; % off-shape, 0.9). 'Kendo' and 'Carmello' were 2 cultivars that did not have any blossom end rotted fruits and 'Amfora' was the only cultivar that did not produce any zippered fruit. The entries that had the smallest disorders/fruit ratio were 'Tango' (0.5), 'Pyrella' (0.5) amd 'Ramy' (0.5).

Discussion

The results indicate that 'Carmello' and GS 130 are 2 greenhouse cultivars that should be commercially tested because they had the best combination of yield, fruit size and % marketable fruit. However, it is important to note that these 2 cultivars are susceptible to Fusarium crown and root rot, Fusarium wilt race 2 and Cladosporium leaf mould. Many of the cultivars tested would not be commercially acceptable in the U.S. because their fruit size was below 165g. Cultivars with medium sized fruit that have valueable characteristics for cultivar improvement are 'Tropic Boy' which was the highest in yield and the lowest in % cracks and 'Kendo' which was one of the lowest in % blossom end rot and was second in fruit smoothness.

Table 4. Comparison of field-grown tomato cultivars for physiological fruit disorders for the entire 5 weeks of the trial.

Entry/ seed source	Type[z]	Disorders /fruit	% Puff	% Cracks	% Off Shape	% Rough	% Off Color	% Blossom end rot	% Zippered	% Mixed[y]
Simona F_1/OE	G	0.8	0.0	55.5	4.6	6.7	0.0	13.0	7.1	22.2
Cancan F_1/OE	G	1.0	0.0	80.0	3.9	8.6	0.0	3.8	10.5	16.7
Palace/TK	G	0.9	0.0	62.6	5.2	7.9	1.0	4.1	13.5	21.3
Tropic Boy/TK	G	0.5	0.8	24.1	8.0	8.4	0.0	8.7	3.1	15.5
Master No.2/TK	G	0.8	0.0	59.9	5.1	11.0	0.0	2.2	8.7	12.9
Fontana/EZ	G	0.7	0.0	58.0	3.6	5.9	0.0	0.5	6.0	7.7
Bermuda/EZ	G	0.9	0.0	72.8	2.9	10.6	0.0	5.3	4.7	11.1
Amfora/EZ	G	0.6	0.0	61.6	0.0	0.3	0.0	1.5	0.0	1.5
Tango/CL	G	0.5	0.0	44.7	2.0	3.7	0.0	2.9	1.0	4.6
Pyros/CL	G	0.9	0.0	74.5	4.6	6.7	0.4	3.3	4.8	11.6
Pyrella/JL	G	0.5	0.0	43.9	2.3	2.9	0.0	0.7	2.0	3.3
Dona/JL	G	0.6	0.4	50.4	1.1	4.2	0.0	5.2	2.2	7.8
St. Pierre/JL	G	0.7	0.0	57.3	2.9	4.6	0.0	9.4	1.6	13.1
Master F_1/JL	G	0.7	0.0	59.5	3.9	9.8	0.0	2.1	3.0	7.9
Fandango/JL	G	0.7	0.0	62.0	4.7	8.7	0.0	2.2	2.2	6.5
Carmello/SG	G	0.8	0.0	70.4	5.9	7.3	0.5	0.0	3.0	8.8
Nancy/SG	G	0.8	0.4	63.2	4.1	6.1	0.4	1.5	3.3	8.9
Erlicor/SG	G	0.6	0.8	51.7	2.0	8.2	0.0	3.9	5.1	10.6
GC 771/SG	G	1.0	0.0	79.2	4.3	10.8	0.0	5.3	8.4	14.9
F. 210/SG	G	0.6	0.0	55.7	0.9	4.1	0.0	0.8	4.1	5.8
Alonso/SG	G	0.8	0.0	55.3	6.9	8.1	0.0	6.2	5.3	16.5
Kendo/SG	G	0.7	0.0	62.6	1.0	1.5	0.0	0.0	4.7	12.3
GS 130/SG	G	0.9	0.0	69.7	1.4	9.0	1.9	5.5	4.3	10.5
Vemar/SG	G	0.8	0.0	61.1	2.0	4.0	0.0	11.4	2.5	14.2
Ramy/SG	G	0.5	0.0	42.3	3.5	3.5	0.9	1.9	2.0	5.0
Rambo/SG	G	0.9	0.5	78.8	2.6	4.6	0.0	2.6	8.8	12.9

Table 4. Comparison of field-grown tomato cultivars for physiological fruit disorders for the entire 5 weeks of the trial. (cont.)

Entry/ seed source	Type[z]	Disorders /fruit	% Puff	% Cracks	% Off Shape	% Rough	% Off Color	% Blossom end rot	% Zippered	% Mixed[y]
GC 779/SG	G	0.8	0.0	65.9	0.9	2.3	0.5	2.9	12.4	16.2
Dombello/BR	G	0.7	0.0	56.7	6.5	12.4	0.0	3.6	3.5	10.4
Jet Star/JH	F	0.8	0.0	35.4	13.1	19.7	0.0	12.1	11.3	27.2
Jumbo/BR	G	0.8	0.0	66.5	4.6	7.0	0.6	5.1	4.9	11.8
CR-6/OH	G	1.2	0.0	76.8	7.7	16.1	0.0	13.7	9.7	24.2
Early Set/JH	F	0.6	0.0	37.5	7.1	11.0	0.4	3.4	6.3	13.3
Pole King/AC	F	0.9	0.0	70.9	5.3	9.9	0.0	4.4	6.7	14.3
Vendor/ST	G	0.8	0.0	65.8	4.9	7.9	0.0	7.4	4.4	12.8
LSD 5%		0.2	NS	16.4	4.9	12.5	0.9	6.7	5.1	8.4

[z]Greenhouse cultivar = G and Field cultivar = F
[y]Percentage of the fruit that had more than one physiological disorder.

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